Session VI

Human Brain Mapping Project. Where Are We?

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MAGNETOENCEPHALOGRAPHY — A NONINVASIVE TECHNIQUE FOR FUNCTIONAL MAPPING OF THE BRAIN

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Magnetoencephalography (MEG) is a noninvasive technique for investigating neuronal activity in the living human brain. In MEG studies the extremely weak 10 fT – 1 pT magnetic fields produced by the electric currents flowing in neurons are measured with ultrasensitive multichannel SQUID (superconducting quantum interference device) magnetometers. The sites of localized sources in the cerebral cortex that are activated by a stimulus or in synchrony with a certain event can be found from the detected magnetic-field distribution, provided that appropriate assumptions about the source render the solution for the inverse problem unique. The time resolution of the method is better than 1 ms and the spatial resolution is, under favorable circumstances, less than 5 mm for sources in the cerebral cortex. Many interesting properties of the working human brain can be studied, including spontaneous activity and signal processing following external stimuli. The interpretation of MEG recordings together with data acquired with other methods, especially with the crisp anatomical information provided by MRI, has made the method a useful functional mapping tool in studies of basic neurophysiology and information processing. For clinical purposes, determination of the locations of epileptic foci has so far been studied most. While modern state-of-the-art systems measuring the field over the whole head are being now being installed to first clinical sites, exploring the usefulness of the good spatio-temporal resolution of the method in the diagnosis of other brain disorders is under way. In this talk, the basics of the method and instrumentation are reviewed together with application examples.

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